



IDENTIFIED ISSUES AND OPPORTUNITIES

MAG Truck Parking Study

August 1, 2021

Prepared

for:



Prepared by:



Contents

1. INTRODUCTION	1
2. SUMMARY OF KEY FINDINGS.....	2
2.1 REGULATORY REVIEW	2
2.2 BEST PRACTICES REVIEW	3
2.3 SURVEY	5
2.4 INTERVIEW SUMMARY.....	9
2.5 ELECTRONIC LOGGING DEVICES MEMO	9
2.6 TRUCK PARKING PATTERNS	11
2.7 ADDENDUM	16
2.8 THE IMPACTS OF AUTONOMOUS TRUCKING	18
2.9 INPUT FROM STAKEHOLDER EXPERT TEAM	18
3. ASSESSMENT OF NEEDS AND SOLUTIONS.....	20
3.1 INDUSTRIAL CLUSTER PARKING	20
3.2 OVERFLOW PARKING AT TRUCK STOPS AND REST AREAS.....	26
3.3 DISPERSED PARKING	28
4. CONCLUSION	29

Figures

Figure 1: MAG Region Local and Municipal Truck Parking Regulations	3
Figure 2: Survey Responses of Reason for Truck Parking Need.....	6
Figure 3: Distribution of Map Markers	7
Figure 4 : Survey-Sourced Locations of Problematic Truck Parking	8
Figure 5: Expanded Daily Parking Rate per Establishment Type, 2-Digit NAICS	12
Figure 6: Parking Occupancy by 2-Digit NAICS	12
Figure 7: Confirmed Undesignated Parking Locations.....	14
Figure 8: Problematic Undesignated Areas	15
Figure 9: Concentrated Undesignated Truck Parking Sites.....	17
Figure 10: Cumulative Hours of Designated Truck Parking by Industrial Cluster	20
Figure 11: Cumulative Hours of Undesignated Truck Parking by Industrial Cluster	21
Figure 12: Industrial Cluster Parking along I-10.....	22
Figure 13: Number of Survey Responses (Lack of Truck Parking and Illegal Truck by Industrial Cluster)	24
Figure 14: Undesignated Overflow Parking at Designated Truck Stop in Phoenix, AZ	26

Tables

Table 1: Potential Strategies Ranked by Average Score	8
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1. INTRODUCTION

The Maricopa Association of Governments (MAG) has initiated a study to evaluate the growing truck-parking demand and the corresponding need for an increased supply of parking options, with a specific emphasis on the industrial clusters in the MAG region. This memo highlights the identified truck parking issues and opportunities that have emerged from the previous memos and tasks completed to-date during the MAG Truck Parking Study. The compiled and summarized previous tasks of this study include input from the following:

- Public and stakeholder outreach
- Evaluation of impacts of electronic logging devices (ELD) and hours of service (HOS) regulations
- Assessment of the region's truck parking supply and demand assessment
- Anticipated industry changes related to technology advancement and automation

Key findings from the review of previous memos cover the following:

- Truck parking availability
- Varied freight regulatory operating environment across the many localities
- Community sentiment related to truck parking
- Supply-and-demand factors for freight operations and parking in the region

This memo shows how the demand relates to the supply of both designated and undesignated truck parking options. This relationship ultimately affects the region's overall freight productivity and safety. Changes in technology, including the emerging trends of autonomous trucking and the potential effect truck parking demand, are also summarized.

Additionally, opportunities for solutions are identified that include public-private partnerships, new technology for leveraging underutilized assets, and better aligning land uses and regulations to relieve the constrained designated truck parking supply. Description of issues and opportunities are specific to regional freight clusters. The findings presented in this memo will be used to develop solutions and recommendations in a subsequent memo.

2. SUMMARY OF KEY FINDINGS

2.1 Regulatory Review

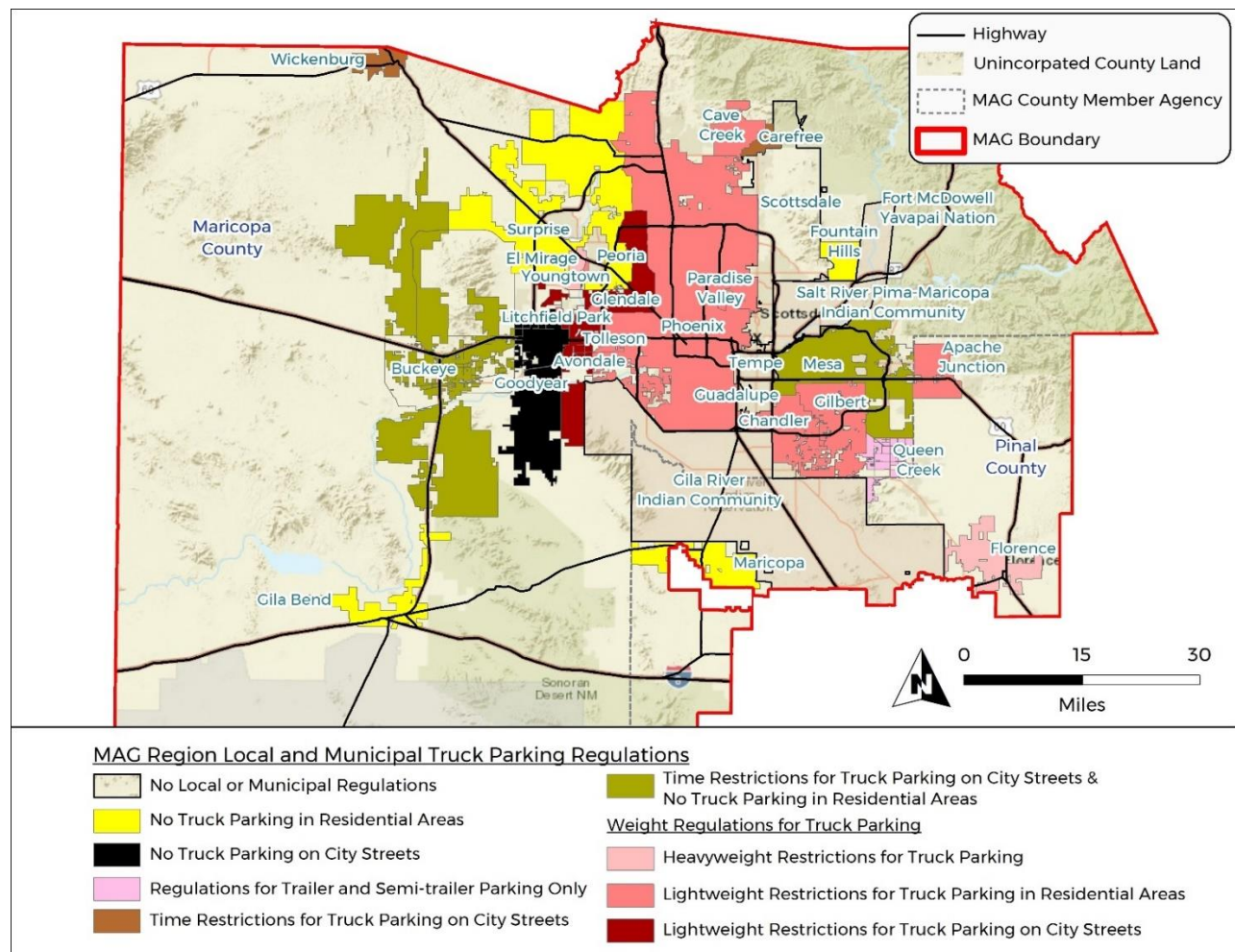
The demand for increased truck parking facilities has grown in part from the overlapping regulations across multiple jurisdictions that limit active driving time, require electronic monitoring for regulation adherence, and restrict public truck parking. When dedicated truck parking facilities are full or too far away, drivers often resort to parking their trucks in undesignated and sometimes unsafe locations to comply with the regulations. Federal regulations governing the electronic logging of HOS, driver safety, transportation of hazardous materials, and banning the commercialization of rest stops on the interstate highway system have produced a restrictive operating environment where drivers must frequently choose between adhering to the HOS limits or parking their trucks unsafely and illegally.

In the MAG region, truck drivers must also comply with the variety of regulations affecting truck parking at the state and local levels. The *Regulatory and Best Practices Review* memo categorizes and elaborates each MAG member agency's local regulations, which range from nonexistent to a complete prohibition of truck parking on any municipal street or road. Common themes among the regulations prevent truck parking on streets in residential areas for noncommercial purposes, set time restrictions for truck parking on municipal roads, and prohibit truck parking within the city based on the weight of the vehicles.

Of the 30 MAG member agencies, three municipalities and all three of the Native American Nations do not have any regulations regarding truck parking on their public streets. A review of the local and municipal codes and statutes indicates seven types of truck parking regulations: six regulation categories not related to weight (Nos. 1 through 6 below) and one regulation category related to weight (No. 7 below) that is further divided to more specific restrictions based on threshold:

1. No Local or Municipal Regulations
2. No Truck Parking in Residential Areas
3. No Truck Parking on City Streets
4. Regulations for Trailer and Semi-trailer Parking Only
5. Time Restrictions for Truck Parking
6. Time Restrictions for Truck Parking on all Streets & No Truck Parking in Residential Areas
7. Weight Regulations for Truck Parking
 - Heavyweight Restrictions for Truck Parking in Residential Areas
 - Lightweight Restrictions for Truck Parking in Residential Areas
 - Lightweight Restrictions for Truck Parking on City Streets

Figure 1 displays the varying local and municipal regulations throughout the MAG region.

Figure 1: MAG Region Local and Municipal Truck Parking Regulations

The MAG region needs increased truck parking capacity. It has been identified especially along the I-10 corridor, which connects the MAG region to the destinations and large markets in California and Texas as well as elsewhere in the nation. An issue here is the range of restrictiveness that municipalities on I-10, and across the MAG region, apply to truck parking. Buckeye, Goodyear, and Avondale have relatively restrictive truck parking regulations, while Phoenix, Tolleson, and Chandler are comparatively more permissive of truck parking. Tempe is the only city along I-10 that does not have any regulation pertaining to truck parking on public streets. A driver passing through the MAG region would not be able to track where it is permitted to park a truck outside of official truck stops. An opportunity exists for easing local regulations for truck parking on local roads in municipalities along the I-10 corridor. At the very least, standardizing the local regulations can be explored to create an understandable and predictable operating environment for freight drivers, perhaps in a buffer zone alongside the corridor.

2.2 Best Practices Review

The federally mandated Jason's Law requires each state to evaluate parking and commercial motor vehicle traffic volumes, and to derive a system of metrics to measure truck parking across the state.

Multiple state and regional agencies have completed truck parking studies that incorporate the requirements of Jason's Law and provide recommendations for improving truck parking across their jurisdictions. A review of these best practices was completed in 2020 to compile a list of potential solutions and parking needs identified by the MAG Truck Parking Study. The studies reviewed include truck parking plans such as the Arizona Truck Parking Study as well as those from states such as Virginia, Utah, Washington, and other regional and local plans such as those from the Mid-America Association of State Transportation Officials and Atlanta Regional Commission. The *Regulatory and Best Practices Review* memo provides a detailed overview of these studies.

The patterns of needs and suggested solutions were broadly similar across the truck parking studies reviewed, and six key strategies encompass and summarize the recommendations compiled from them:

1. Data and Technology Deployment

- Primarily utilized to provide real-time communication to truckers about truck stop and rest area locations and parking space availability.
- Includes sensing technologies such as in-pavement sensors, entry-exit gates, and camera systems to determine parking space utilization and availability and communication media such as dynamic message signs, smartphone and web apps, and in-cab navigation to disseminate the real-time information to truckers.
- For a lower cost solution, some states also recommend installing static truck parking signage on highways and distributing visor card trucking maps to truckers at trucking conferences and other events.

2. Public Truck Parking Capacity Expansion

- Primarily focused on expanding truck parking spaces serving interstate highways or other roads with high parking needs.
- Supply/demand analyses can be completed on major routes across the region to determine locations of high-demand and/or low supply of truck parking spaces.
- GIS analyses may be completed on urban land parcels to determine viability of conversion into truck parking areas.
- Creative use of publicly owned excess rights-of-way at existing parking lots, weigh stations, service areas, and other locations on interstates, as well as improved geometrics at existing locations.

3. Capacity Expansion through Public-Private Partnerships

- Where right-of-way for capacity expansion is lacking, partnering with private businesses and truck stops to expand parking facilities and coordinate signage is recommended, because improved parking spaces and information was found to be important to drivers.
- Where public funding is insufficient, cost-sharing agreements for construction and maintenance of parking areas with private partners may be useful. Private partners may also be allowed to set up commercial stalls (providing amenities such as refreshments and repair shops) at such facilities to provide revenue incentives for engaging truck parking expansion.

- Partnering with businesses that are served by freight to explore on-site warehouse and distribution center parking may provide an opportunity to coordinate on staging requirements as well as expanding short-term truck parking spaces required by drivers.

4. Policy and Regulations

- Review local and regional policies on truck parking and staging requirements to confirm whether parking expansion is being hampered by regulations.

5. Coalitions and Institutional Oversight

- Designate truck parking champions and/or establish truck parking committees within public agencies to champion truck parking goals and oversee implementation of truck parking plans and objectives.
- A cohesive regional or multi-state truck parking plan with the following goals: match supply and demand, increase roadway safety and policy conformity, and reduce the time required by drivers to find safe parking spaces.

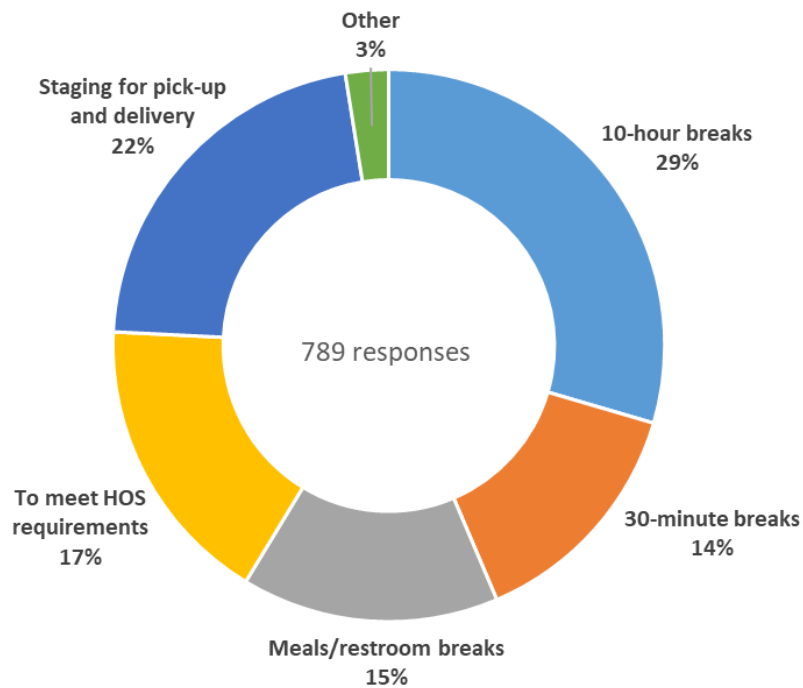
6. Public and Private Strategies

- One of the main impediments to expanding truck parking is public opposition to private truck parking. Coordinating with metropolitan and regional planning organizations to develop guidelines and mitigation strategies can be aimed at easing such public opposition.

2.3 Survey

A survey administered in 2020 asked truck drivers about their impressions of truck parking conditions in the MAG region. This survey received 11,005 data points and 299 comments from 309 participants during the August 5, 2020, to September 21, 2020, collection period. The majority of the respondents were experienced truck drivers who operate nationally and have no home base in the MAG region. (See *MetroQuest Survey Overview and Results* memo for a detailed overview of the characteristics of the respondents and the answers they provided.) This section highlights the needs and solutions identified in the survey.

Truck drivers indicated that they have a need for both parking to stage for logistical reasons and parking for rest (overnight and throughout the day). For logistical staging parking, the main need is for a parking location that is close to the destination of their trip, so they can mitigate the risks of congestion and ensure a timely arrival. Comparable needs exist at the origin of trips too, which are subject to pick up time windows. For rest parking, the truck drivers expressed a clear need for amenities, such as restrooms and food services, safety (such as lighting), and the ability to be confident that a space will be available when they arrive at the parking facility. **Figure 2** summarizes the responses for the varying needs of drivers and operators for truck parking.

Figure 2: Survey Responses of Reason for Truck Parking Need

The survey found that truck drivers have difficulty finding both types of parking. In answering the question, “What are the Main Truck Parking Issues in the Greater Phoenix Area?”, respondents indicated that the top three truck parking needs in the region are the following:

- Lack of parking availability
- Limitations on parking
- Knowing whether parking is available

Approximately 80% of respondents typically spend over 30 minutes looking for parking in the area, while nearly half reported difficulty finding parking in the area three or more times per month. The availability of parking in the area was rated as “Poor” or “Very Poor” by 90% of truck drivers surveyed. These results echo the findings of the Arizona Truck Parking Study for the Phoenix area.

Survey participants were also asked to place at least three markers on a map of the greater Phoenix area to identify locations of truck parking issues, noting if the issue pertained to the following:

- Lack of parking
- Illegal parking
- Lack of amenities
- Safety
- Enforcement
- Other matters

Figure 3 shows how the markers and comments were distributed among the identified issues. The majority (72%) of markers represented areas lacking parking. Most of the remaining markers represented safety or the lack of amenities. Very few markers were placed for illegal parking, enforcement, or other matters. The results reinforce the conclusion that lack of truck parking capacity is the most significant need for truck drivers.

Figure 3: Distribution of Map Markers

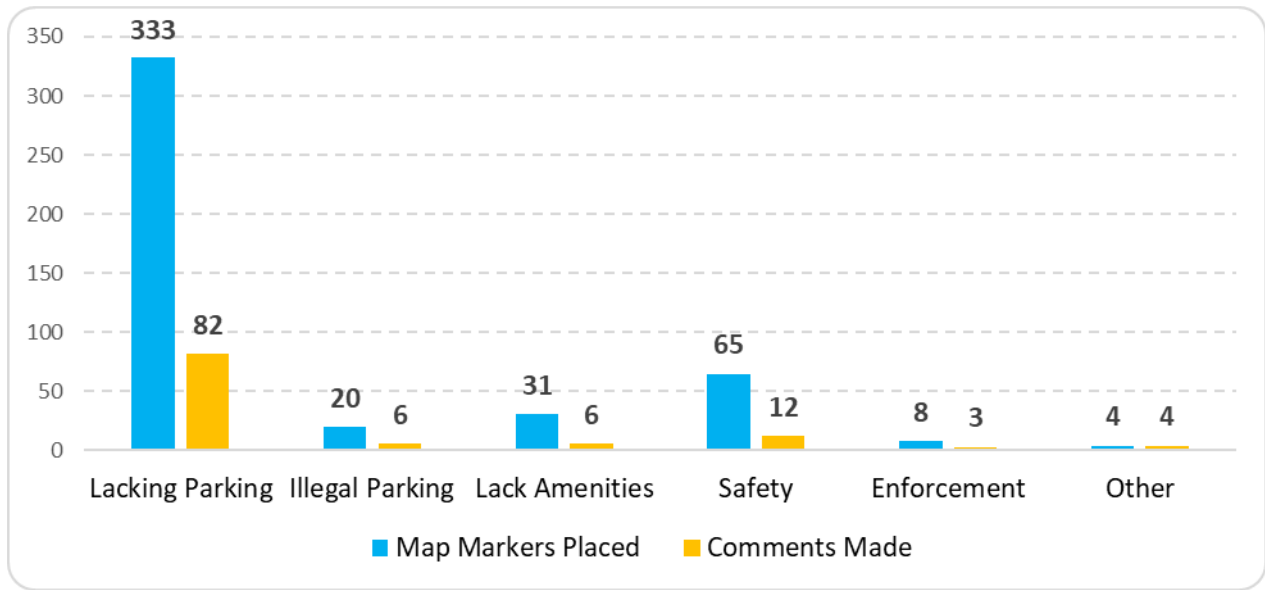
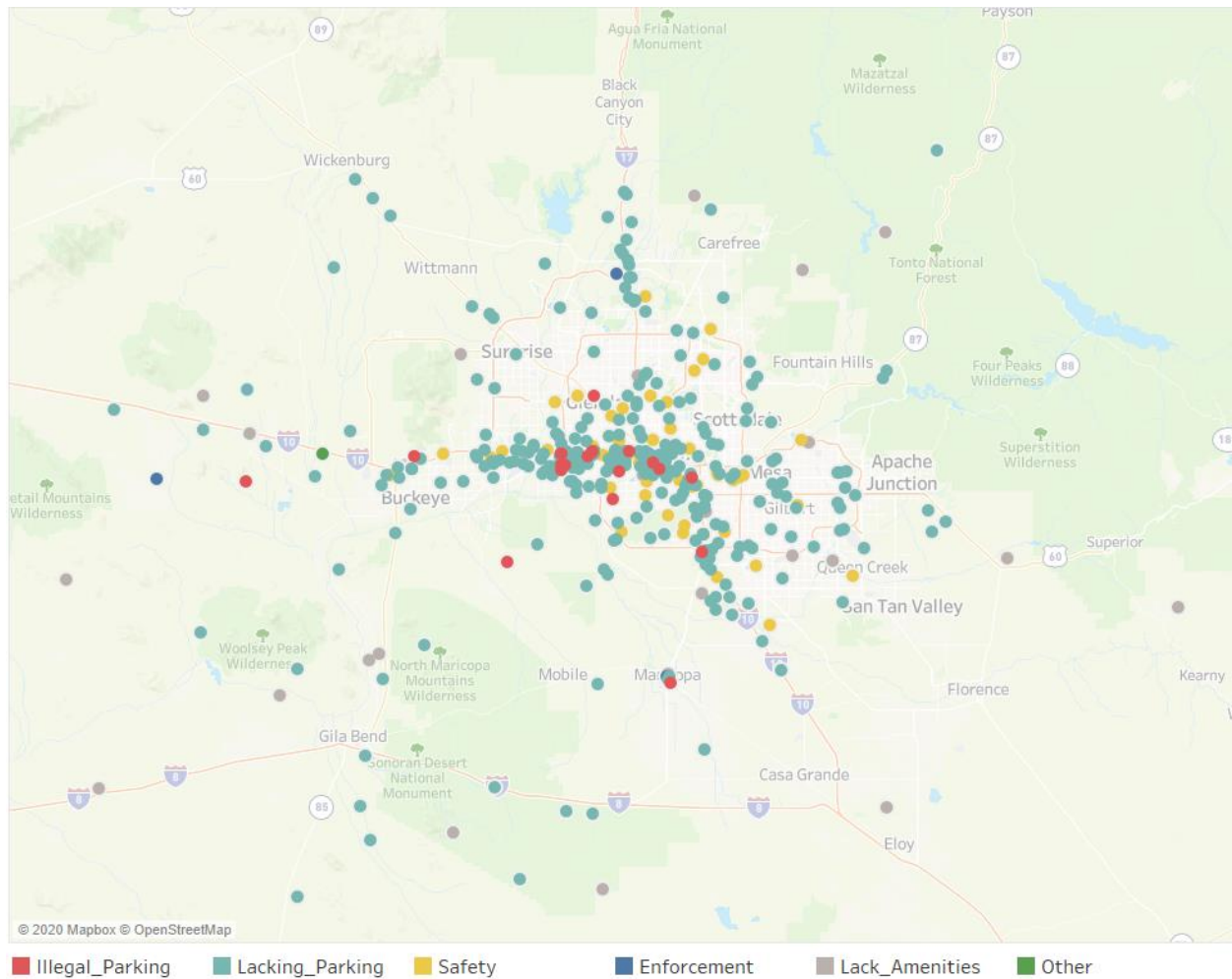


Figure 4 visualizes these locations, by issue type, within the MAG region. These survey-sourced locations were used to compare and validate the undesignated parking locations developed using a GPS analysis of truck movement data from the American Transportation Research Institute (ATRI). A visual analysis of the distribution of survey locations yielded similar patterns to those presented in the *Truck Parking Patterns* memo: a concentration of locations around industrial regions and along interstate corridors.

Figure 4 : Survey-Sourced Locations of Problematic Truck Parking

Truck drivers were also asked to rate various strategies that could address parking issues. As shown in **Table 1**, there were high levels of support for most strategies. ‘Expansion of Facilities’ was the most popular, strategy followed closely by both ‘Increased Street Parking’ and ‘Technology.’ The highest rated sub-strategy was ‘Require shippers to allow parking for staging on-site,’. This sub-strategy was within the ‘Delivery Hours’ strategy. By far the lowest rated strategy was ‘Paid parking.’

Table 1: Potential Strategies Ranked by Average Score

STRATEGIES	AVERAGE SCORE
Expansion of Facilities	4.3
Increased Street Parking	4.2
Technology	4.1
Delivery Hours	3.9
Paid Parking	2.4

2.4 Interview Summary

Stakeholder outreach activities were conducted in order to learn about operating conditions and concerns around truck parking. Interviews revealed that there is also a high volume of truck traffic passing through the region and that these trucks have overnight (10-hour break) parking needs. This demand adds to the overall issue of the need for truck parking beyond what is required for the inbound and outbound requirements for freight deliveries or pickups in the region. Another highlighted parking concern was the need to stage trucks for on-time pickup and delivery assignments. This has been described in other documents as “logistical” parking.

Interviewees noted that retail and some customer/vendor locations offer the opportunity of allowing truck parking on-site because these facilities often have better lighting and some level of security that is attractive to drivers. While retailers are sensitive to the interaction between the trucks and their own customers, there is an opportunity to provide some relief to the parking situation. However, their willingness to provide parking can be thwarted by jurisdictional regulations that create restrictions, as described in the *Regulatory and Best Practices* memo.

An issue expressed in the interviews was rapid commercial development—particularly for large warehouse complexes—which has created several problems for truckers. One specific issue noted multiple times was the desire to maximize the building footprint for business revenue and municipal tax purposes. In many cases, this has been accomplished by eliminating on-site truck parking and narrowing the streets that trucks must use to operate around facilities. Additionally, residential and mixed-use activities have grown in areas previously designated as industrial. This has restricted the space available for trucking and truck-stop facilities to expand around these locations. The regulatory framework is controlled at a jurisdictional level, and participants felt that greater cooperation across jurisdictions is needed to address these concerns.

Interviewees noted several safety concerns related to a lack of truck parking. Drivers have concerns for their personal safety and seek parking with lighting, amenities, and security services provided. Additionally, some truck parking areas attract illicit activities which most drivers prefer to avoid.

Even with the 30-minute break HOS regulation having been relaxed in 2020, trucking operations are still significantly impacted by overnight parking and more particularly by the need to stage near facilities for on-time pickup and delivery of loads. Interviewees expressed concerns that hours of access and shipping and receiving processes are set to optimize warehouse operations at the expense of transportation operations.

2.5 Electronic Logging Devices Memo

Electronic Logging Devices (ELDs): Supply Chain Impact and Assessment memo evaluated the impact that ELD regulations have had on the regional logistics market. The HOS and ELD regulations limit available transportation capacity in a regional logistics market. HOS regulations are intended to balance the safety of everyone on U.S. roads, including truck drivers and the general public, with the productivity of transportation and the income of commercial drivers. HOS regulations are in place to make the decision

in favor of safety straightforward and consistent across the millions of drivers at work in the United States each day. The ELD mandate was enacted to improve compliance with HOS regulations across the commercial trucking landscape. The previously existing method of logging a driver's duty hours on paper allowed drivers room to complete the documentation with some leeway in accuracy. The ELD mandate limits flexibility with respect to compliance with the regulations. Regulators believed that better compliance with the HOS regulations would reduce the incidences of drivers operating vehicles while fatigued and, therefore, improve highway safety.

The ELD mandate took effect in January 2017 and accentuated the growing issue of adequate truck parking on the nation's highways and in metropolitan areas. The mandate highlighted that parking infrastructure is a significant factor in highway safety.

Further issues arise when freight carriers and individual drivers report stress associated with lost utilization in their day-to-day work as a result of the ELD mandate and HOS regulations. Proper trip planning depends on availability of parking, whether it is for long-haul routes or regional deliveries. Determining when and where to park for required breaks and rest creates anxiety and stress for the driver. All types of drivers experience this "range anxiety" nearly every day; it is their new normal. To cope with range anxiety, drivers often stop earlier than required, which results in diminished transportation productivity and throughput.

On May 14, 2020, the Federal Motor Carrier Safety Administration announced a final rule updating HOS regulations for commercial motor vehicle drivers. This rule change does not alter the ELD requirements but does revise some HOS regulations that the ELD mandate enforces. The regulation changes provide more flexibility than the previous regulations, primarily through the following four changes:

- On-duty limits for short-haul operations increase from 12 to 14 hours and from 100 air-miles to 150.
- The adverse driving provision now extends the driving window 2 hours if the driver encounters adverse driving conditions.
- In addition to splits of 10/0 and 8/2, drivers are allowed a split-sleeper option of 7/3. Additionally, the qualifying period does not count against the 14-hour window.
- The 30-minute break provision now requires the break after 8 hours of consecutive driving time (instead of on-duty time) and allows an on-duty/not driving period to qualify as the required break.

The rule change subsequently went into effect on September 29, 2020. While this rule change increases flexibility, the need for adequate truck parking remains. Drivers still face the uncertainty of finding truck parking to meet their needs. Statewide freight planning and truck parking initiatives have proposed solutions for truck parking, particularly for overnight. They have also identified elements of the truck parking challenge that extend beyond the physical infrastructure that include jurisdictional regulations and negative public opinion pertaining to truck parking.

The parking infrastructure needs will only increase over time as the demand for freight and the number of trucks on the highways reach new volumes. Arizona and the MAG region are affected by the growth in regional and local needs, as well as supporting the national supply chain with services for through traffic.

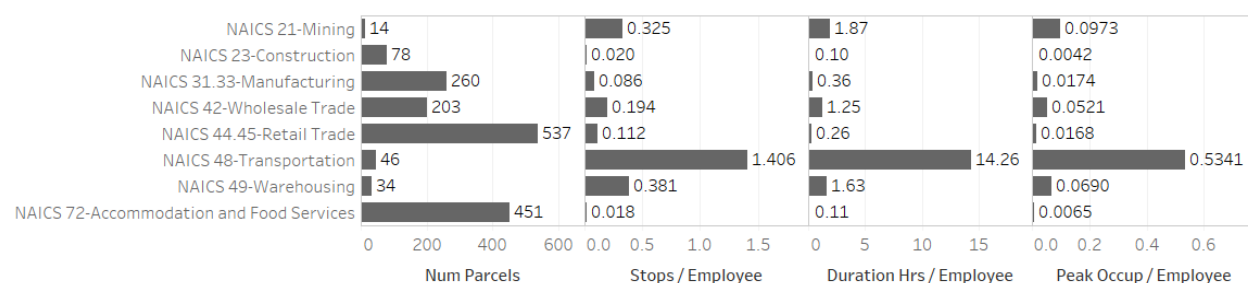
The Arizona Department of Transportation Truck Parking Study identified the opportunity for collaboration among public and private stakeholders on solutions, including MAG efforts on parking initiatives and public-private partnerships (P3) for parking-specific projects. The partnership needs to extend to land development and zoning agencies as the search for available capacity continues. This issue was mentioned repeatedly in the MAG interviews. The buildout of warehouse space in the region adds to the truck volume and exacerbates parking needs. This aspect of development may not have received enough attention in the effort to maximize revenue-generating and taxable land use.

2.6 Truck Parking Patterns

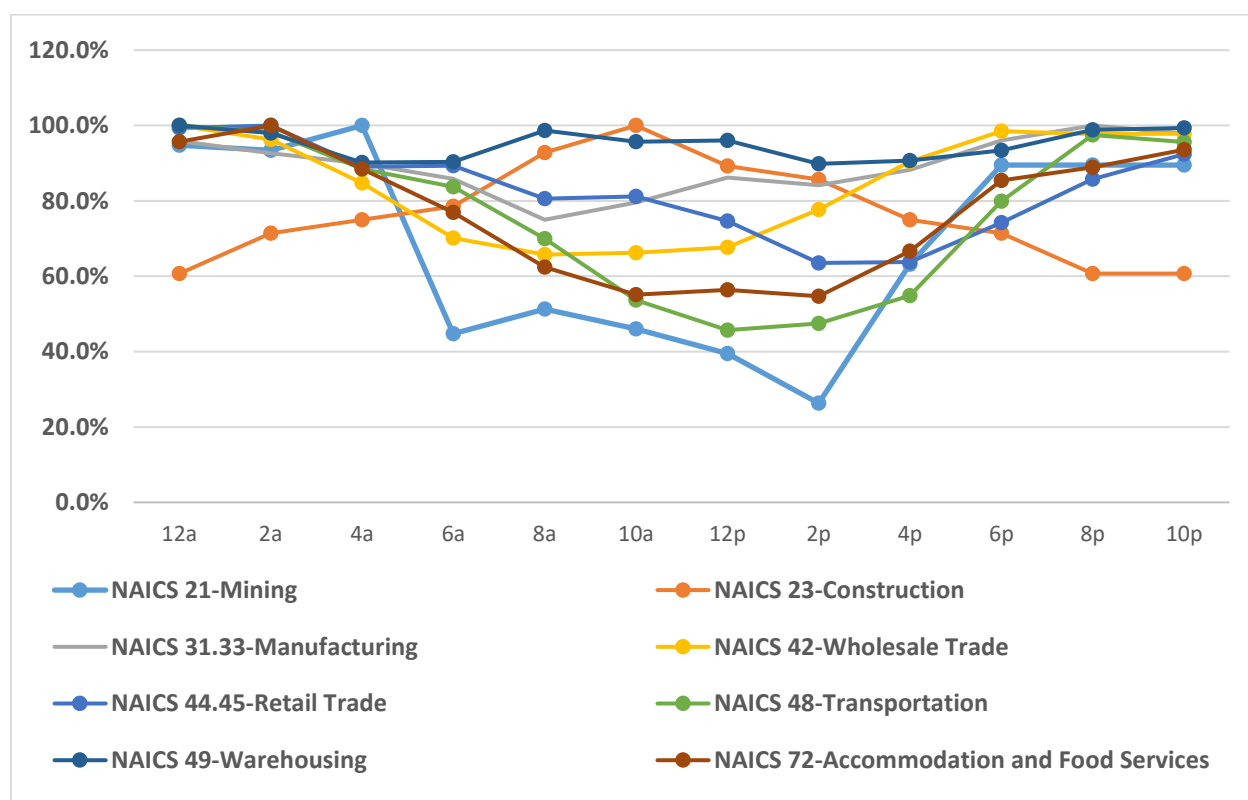
2.6.1 Commercial and Industrial Parking

Where, when, and for how long trucks need to park is in many ways determined by the requirements of their customers, which are mainly commercial and industrial establishments. Truck GPS data was analyzed to understand how trucks park at different types of commercial and industrial establishments. Some of these establishments might be freight intensive, and require frequent truck deliveries and pickups, leading to large parking needs. Other establishments might require far less trucking and associated parking.

Figure 5 provides an overview of key designated parking statistics broken out by the establishment type of the businesses served by the parking facility. This graphic was generated by combining the truck GPS data referenced above with establishment location data provided by MAG at the North American Industry Classification System (NAICS) Code level. Establishments in the Transportation sector (NAICS 48) generate the greatest demand for parking per employee, which includes truck terminals. The Warehousing (NAICS 49) sector is second in terms of parking demand followed by the Mining (NAICS 21) sector, where demand is generated at quarries in the region such as in Peoria. The Wholesale Trade (NAICS 42) sector also generates significant parking per employee. Parking rates for the Manufacturing sector (NAICS 31 to 33) vary widely when analyzing individual subsectors and are mainly contingent on whether the manufacturing activity requires or generates bulky commodities, and therefore has significant transportation requirements. Higher value manufacturing, particularly of electronics, has small parking demand. The analysis also indicates that parking demand varies significantly within the Manufacturing sector; therefore, in this sector parking demand should be modeled or estimated at the subsector level (i.e., at the 3-digit NAICS level).

Figure 5: Expanded Daily Parking Rate per Establishment Type, 2-Digit NAICS

A temporal analysis shows truck parking patterns vary significantly by industrial sector. Industrial and commercial land uses observe the highest occupancy (number of trucks on their property) during the night (**Figure 6**). Manufacturing and wholesale establishments see a similar pattern where occupancy peaks overnight, and then falls to about 60% of the peak during daytime. This pattern likely reflects the prevalence of private truck fleets that are being stored overnight at these establishments. On the other hand, the Warehousing and Retail sectors follow a different pattern, with occupancy peaking in the midnight and morning hours but remaining high throughout the day. For-hire truck fleets utilized in these sectors complete both supply (inbound) and delivery (outbound) trips from warehouses, with the early morning trips reflecting primarily inbound trips.

Figure 6: Parking Occupancy by 2-Digit NAICS

As further detailed in the *Truck Parking Patterns* memo, the peak of truck activity determines the amount of parking needed at an establishment. Industries with a steeper peak curve tend to have a harder time maintaining sufficient parking to accommodate the truck parking demand.

Because of the overall higher demand as well as the peaking patterns, industrial and commercial establishments have a significant impact on logistical parking needs. While a few establishments provide ample parking for trucks on their premises, the majority do not, because of the expense of land and for liability reasons. Most trucks are allowed to enter the establishments only near their appointment time, which generates a need for staging parking near these establishments. The amount of staging parking needed will increase during the times of the day when that type of facility sees the highest freight activity.

2.6.2 Rest Area and Truck Stop Parking

The truck GPS data was also used to quantify parking at rest areas and truck stops. Parking in commercial truck stops (not included in estimates for commercial land uses) accounts for 7.2% of stop duration, while parking at rest areas accounts for just 0.4% of stop duration, relative to all parking in the MAG region. Parking at rest areas is typically shorter (2.2 hours/stop) compared to commercial truck stops (4.2 hours/stop). The following truck stops that see the highest demand are on I-10 in the western part of the MAG region: Flying J 611, Pilot Travel Center 459, and TA 255. Occupancy was observed to vary more throughout the day at rest areas than commercial truck stops, with both observing peaks in occupancy in the early morning.

2.6.3 Undesignated Parking

Undesignated parking was found primarily in vacant, transportation, agriculture, and open space land uses. As shown in **Figure 7**, while not confined to only a specific geography in the MAG region, undesignated parking was found to generally occur along major truck corridors (such as the I-10, Route 60 and I-17). It was also found adjacent to major truck trip generators/attractors (such as industrial centers in Phoenix and Tolleson, distribution centers across the region, and the Phoenix-Mesa Gateway Airport). Undesignated parking was found to occur both on-street and to cluster around truck stops, indicating limited parking availability at these facilities. On-street parking and overflow at truck stops, which are indicative of capacity not matching demand, were more likely to create problems due to the safety concerns they pose to both trucks and other road users.

As further described in the *Truck Parking Patterns* memo, significant undesignated truck parking locations were then studied to identify those that were problematic. Problematic truck parking included safety issues due to crash potential, security issues with respect to geographic isolation and lack of lighting, or potential nuisance to residential communities. **Figure 8** shows the results of an analysis that identified problematic undesignated parking locations. These locations also exhibited the general patterns found in the analysis of the top 128 undesignated parking locations. They were more likely to be present along the interstates and Route 60, and more likely to be present at truck stops near major distribution centers and other trip attractors within the region.

The top problematic locations validated by field visits conducted by MAG staff broadly represent the patterns of undesignated parking observed throughout the region. Both GPS data and field visits suggest two specific patterns of higher concentration of undesignated parking:

- On-street/unmarked lot parking around distribution centers in the industrial zones in Phoenix and Tolleson
- Overflow from truck stops outside Phoenix (along the interstates and Route 60) that serve as staging locations for drivers looking to enter Phoenix in the morning or looking to meet HOS regulations.

Figure 7: Confirmed Undesignated Parking Locations

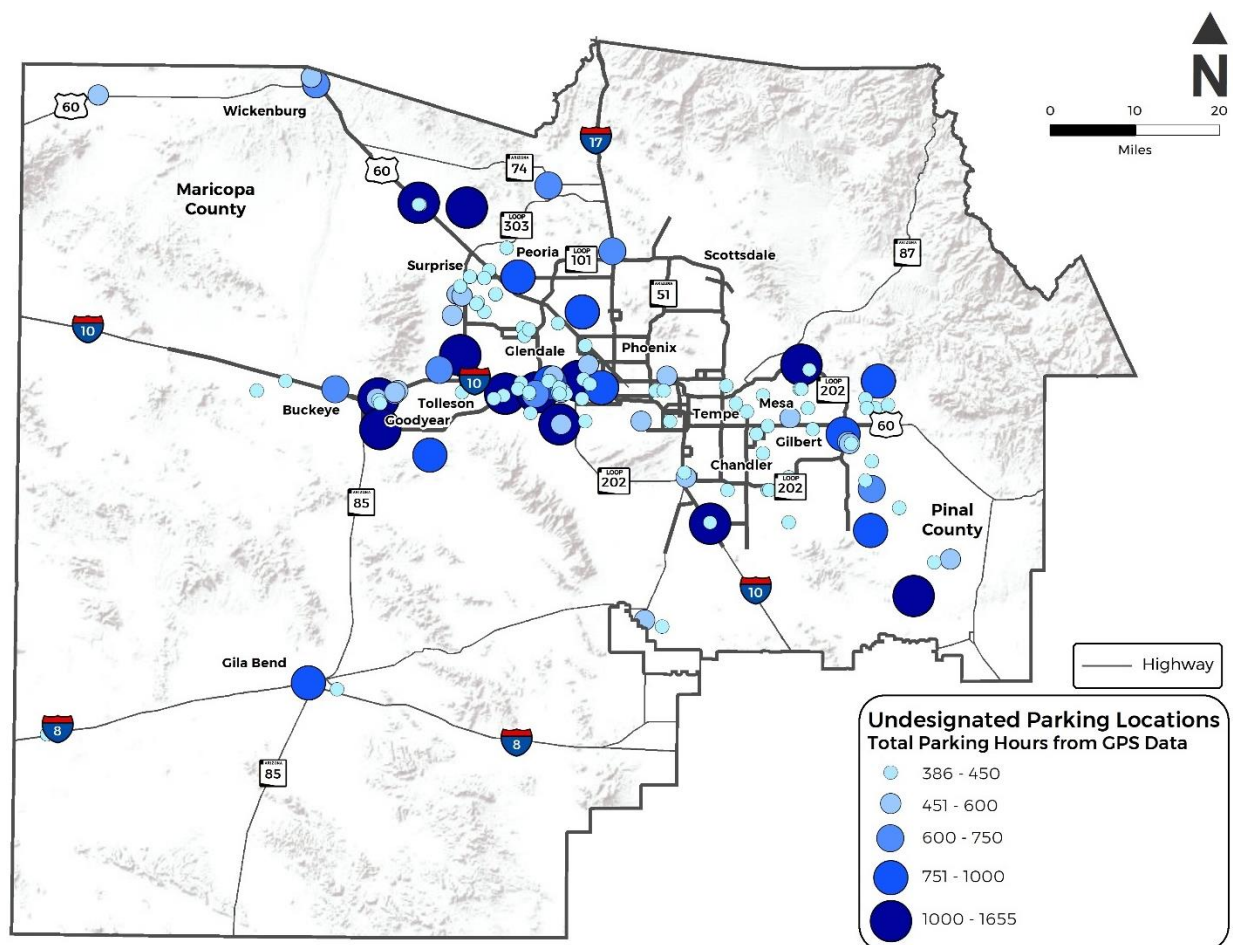
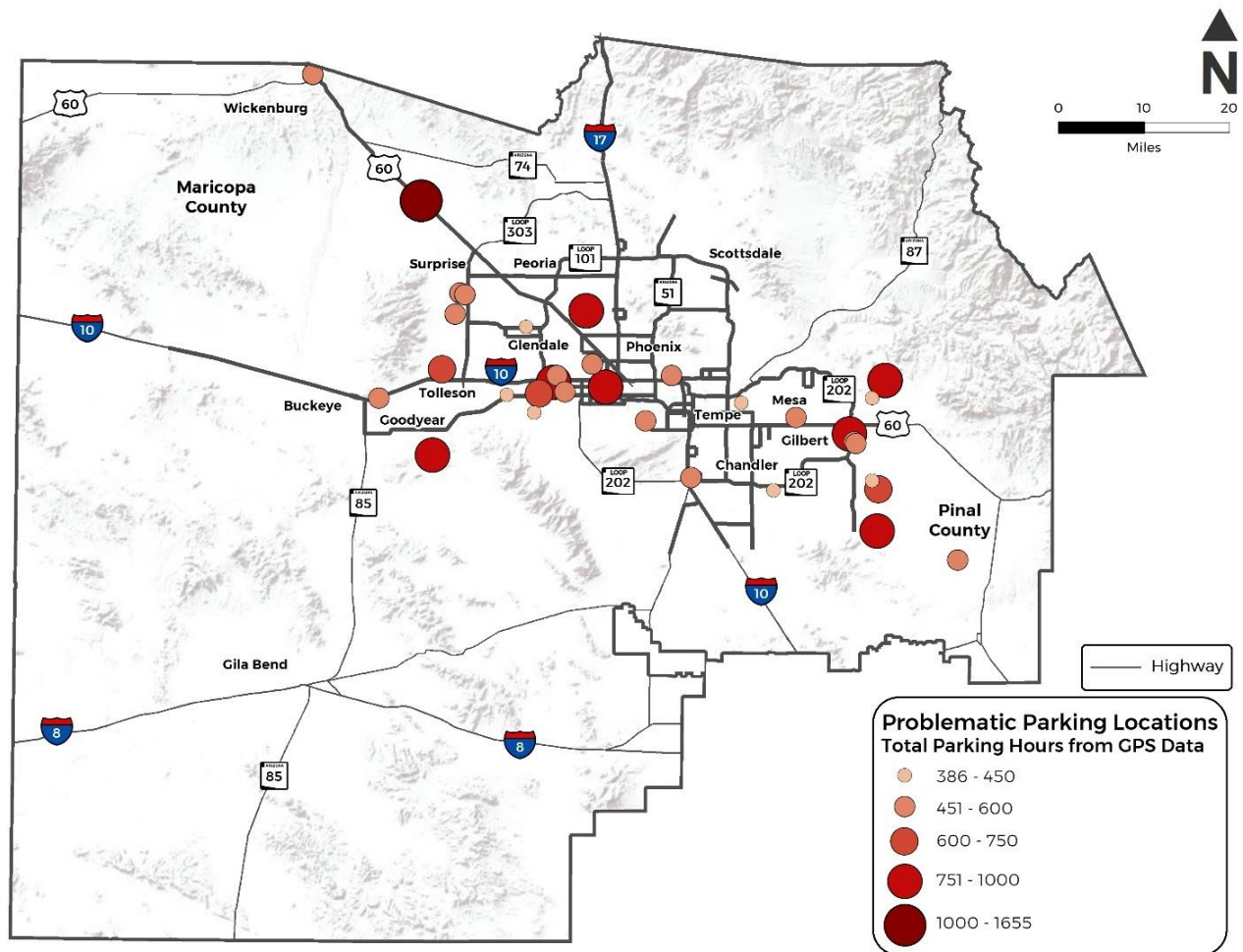


Figure 8: Problematic Undesignated Areas



While the factors contributing to undesignated parking vary across individual locations, the following were the most common issues:

- Lack of parking capacity at truck stops servicing nearby distribution centers
- Absence of staging locations (or lack of clear markings) near major trip generators (such as the distribution centers mentioned above)
- Lack of sufficient parking capacity at truck stops along major truck corridors overnight for drivers looking to meet HOS regulations
- Poor lighting at unmarked lots and at overflow parking locations, leading to safety and security issues

2.7 Addendum

The addendum focused on 14 sites in the MAG region identified as having significant, problematic undesignated truck parking based on GPS and survey data. Each site was visited for verification purposes and summaries of nearby available truck parking, sources of truck traffic and adjacent land uses, were provided.

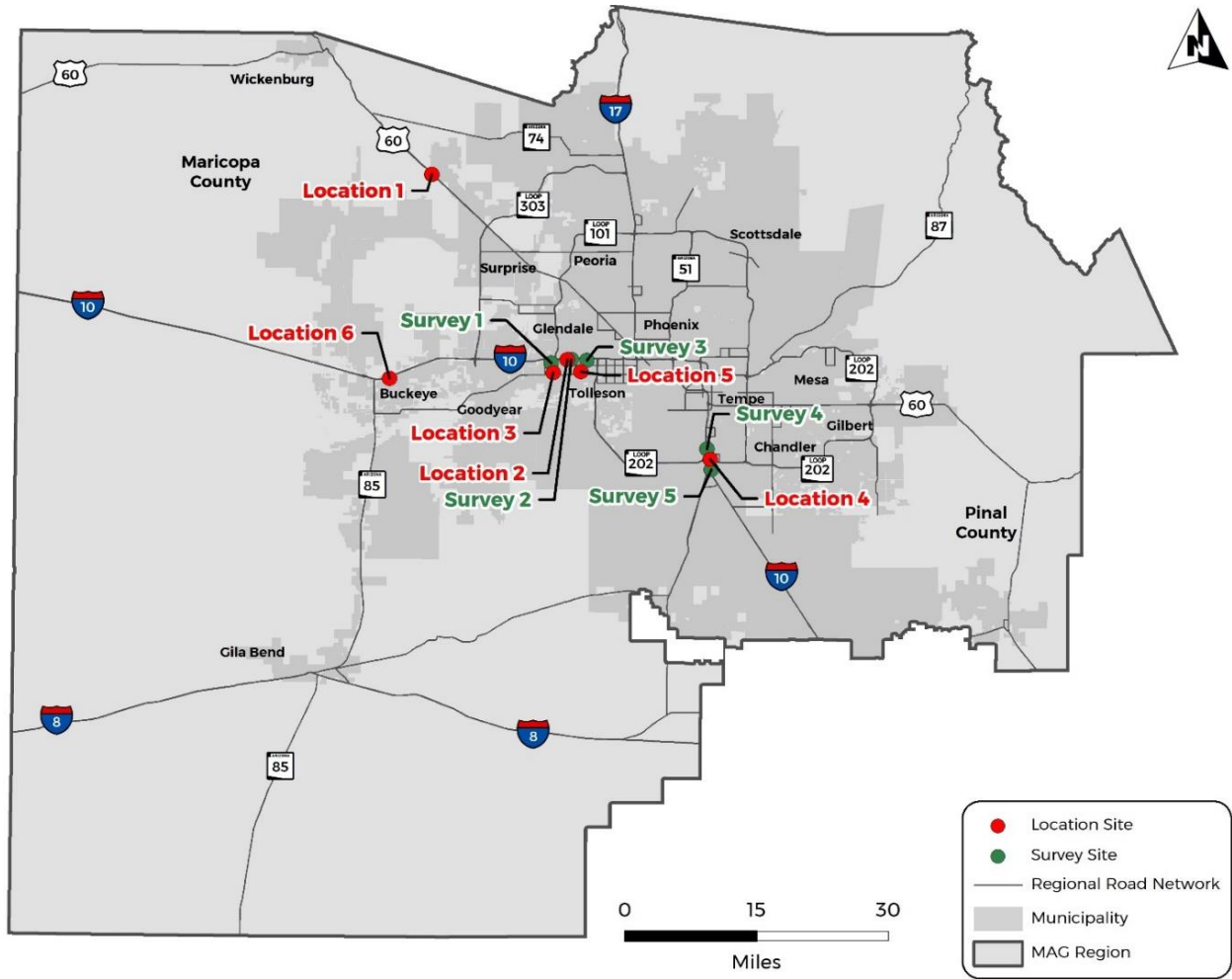
Figure 9 shows the locations of the concentrated undesignated truck parking sites in the MAG region which were evaluated in the addendum. Most of the sites are along the I-10 corridor, with several in Tolleson.

The sites were also evaluated in terms of their issues related to truck parking. The undesignated truck parking issues at these sites stem primarily from the need to comply with the federal HOS regulations for truck drivers and staging for deliveries. The common issues at these sites are a lack of adequate truck parking at designated truck stops or a lack of parking at warehouse locations, particularly at grocery and snack food distribution warehouses. The high volume of trucks accessing these food distribution centers and their unpredictable loading/unloading times both exacerbate the truck congestion around these facilities. Drivers often resort to parking and waiting nearby to avoid deviating from efficient routing of their planned schedule.

Many of these sites are well-signed with No Parking signs on the local roads and nearby parcels that are not truck stops. However, drivers still resort to parking their trucks in undesignated locations on local roads when they need to stop and rest or wait to gain access to their destinations.

The addendum highlighted opportunities for addressing these truck parking issues. Potential solutions identified were location specific but include directing drivers to nearby designated truck parking, coordinating with local retailers and shippers to allow truck parking, developing new or expanded designated truck parking, and permitting more on-street truck parking. Many of the undesignated truck parking sites have some vacant parcels nearby that could be an option for developing additional truck parking capacity. Transforming these vacant parcels into truck parking may prove difficult because any development would require funding and even partnerships between private and public entities. However, temporary use might be a less challenging option.

Figure 9: Concentrated Undesignated Truck Parking Sites



2.8 The Impacts of Autonomous Trucking

The *Understanding the Impacts of Autonomous Trucking* memo was developed to assess the degree and timing of the impact that vehicle technology could have on truck parking. The memo reviewed trends in autonomous trucking and related technologies and considered probable scenarios for the short-, medium-, and long-term futures of automated freight operations.

Automated vehicle technologies continue to develop and enter the mainstream transportation environment, including applications on large commercial trucks. The current early stage of development and implementation of automated vehicles presents opportunities for varying levels of automation in future freight operations. A significant fleet turnover to truly autonomous trucking using fully self-driving vehicles with no driver is far into the future. There is even some question as to whether that future will ever present itself. Platooning—a form of automation that can vary from lower to higher levels of automation—has run into operational challenges limiting its utility to-date. As with many of the emerging freight technologies, alone they are simply building blocks; together, they are solutions. The technologies like telematics, artificial intelligence, and machine vision create vehicle capabilities and innovations.

The memo concluded due to the long timeframe for significant fleet turnover to fully autonomous trucks, truck parking issues—such as a lack of parking capacity at distribution centers, lack of staging locations, sufficient parking capacity at truck stops, or poor lighting/services—still must be addressed. These items will not be addressed with autonomous trucks or technology alone in the near or medium terms. However, the memo noted that, as we develop solutions to the truck parking needs, we must remain mindful of the fact in the long term, the demands may change. It recommended priority should be given to shared parking and other options that limit the need for new development.

In keeping with these recommendations, Chapter 3, “Assessment of Needs and Solutions” of this memo first offers solutions to avoid new truck parking facilities, such as dissemination of truck parking information and shared parking options. Where new truck parking locations appear to be necessary, lower-development approaches are suggested.

2.9 Input from Stakeholder Expert Team

The MAG Truck Parking Study’s Stakeholder Expert Team (SET) gave feedback on proposed solutions for the MAG region’s truck parking needs during two meetings over the course of the project study. Overall, the primary issue that the SET identified was the lack of designated truck parking, and the SET saw a need for designated parking for both short- and long-term durations. Input was also collected regarding comments on specific locations where truck parking needs and issues are a primary concern. Trucks were reported to park in undesignated areas near Tolleson and the McDowell Road Corridor in the West Valley just off I-10. There are safety issues when parking in undesignated locations since parked trucks can make roadways tight and narrow even when parked off the road, and drivers have difficulty re-entering traffic from the undesignated locations.

Solutions and opportunities favored by the SET members included installing new technology and dynamic message signs for real-time information of regional truck parking capacity, exploring public-private partnerships with large retailers to allow truck parking in their underutilized parking lots, and

requiring warehouses in industrial zones to provide on-site truck parking and staging. Many of the solutions that the SET affirmed are low-cost improvements which would leverage existing assets.

The SET provided input that some proposed solutions might be more difficult to achieve or even not be worth further pursuit. These included building new truck parking capacity—particularly on-street—increasing the street parking available for trucks, incentivizing businesses to accept deliveries throughout the day, and promoting paid parking and reservations at designated truck parking facilities. Both truck drivers and public officials expressed safety concerns related to increasing on-street truck parking capacity. Some members of the SET are also reluctant to use financial incentives to distribute costs among truck drivers and operators to solve the region’s truck parking capacity needs.

3. ASSESSMENT OF NEEDS AND SOLUTIONS

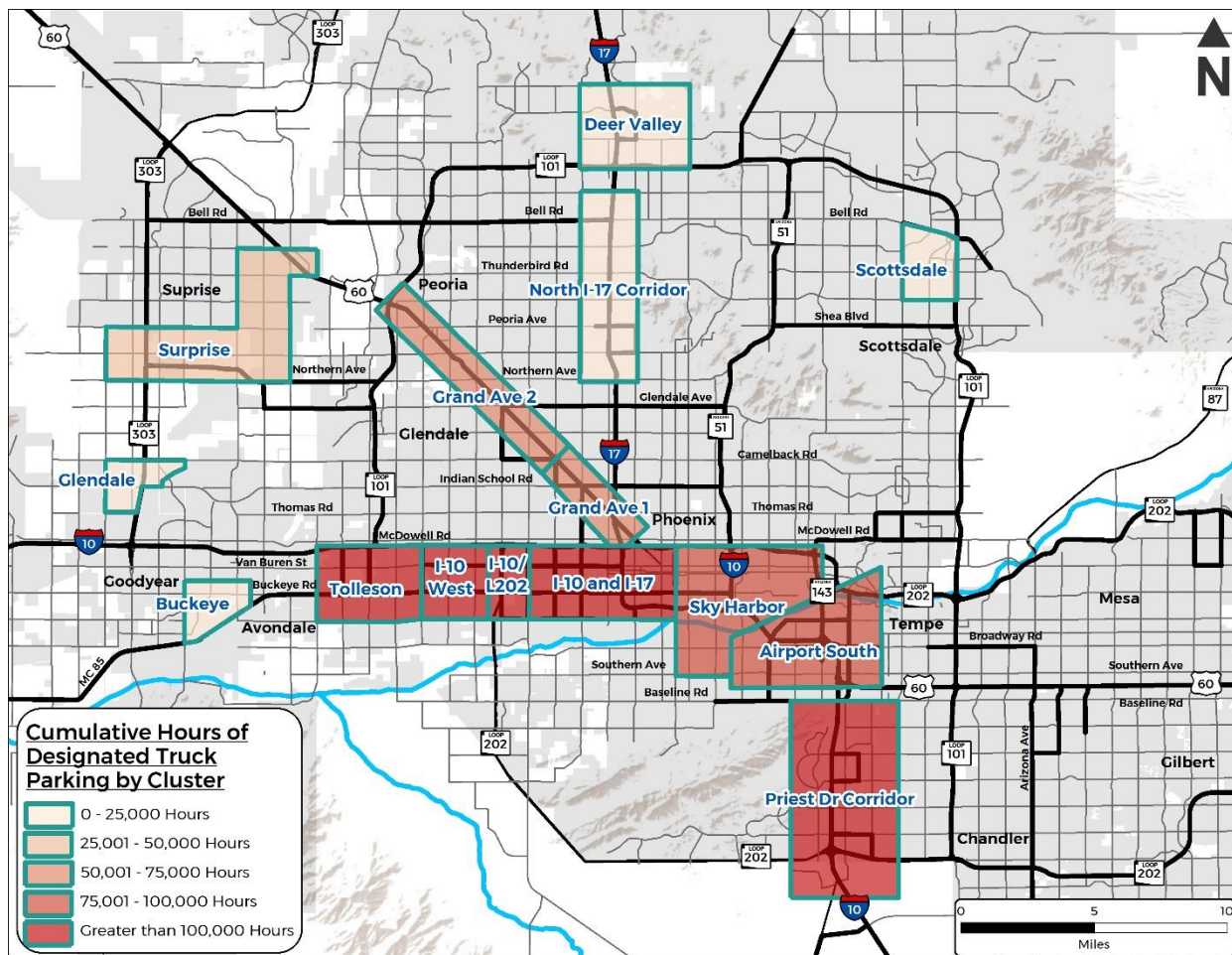
3.1 Industrial Cluster Parking

3.1.1 Need

As described in previous memos, a clear need exists for parking in and around industrial areas. Some industrial land uses are freight intensive, requiring frequent truck deliveries, while others do not attract or generate major trucking activity (usually higher value products). However, industrial land uses generally had the highest parking needs.

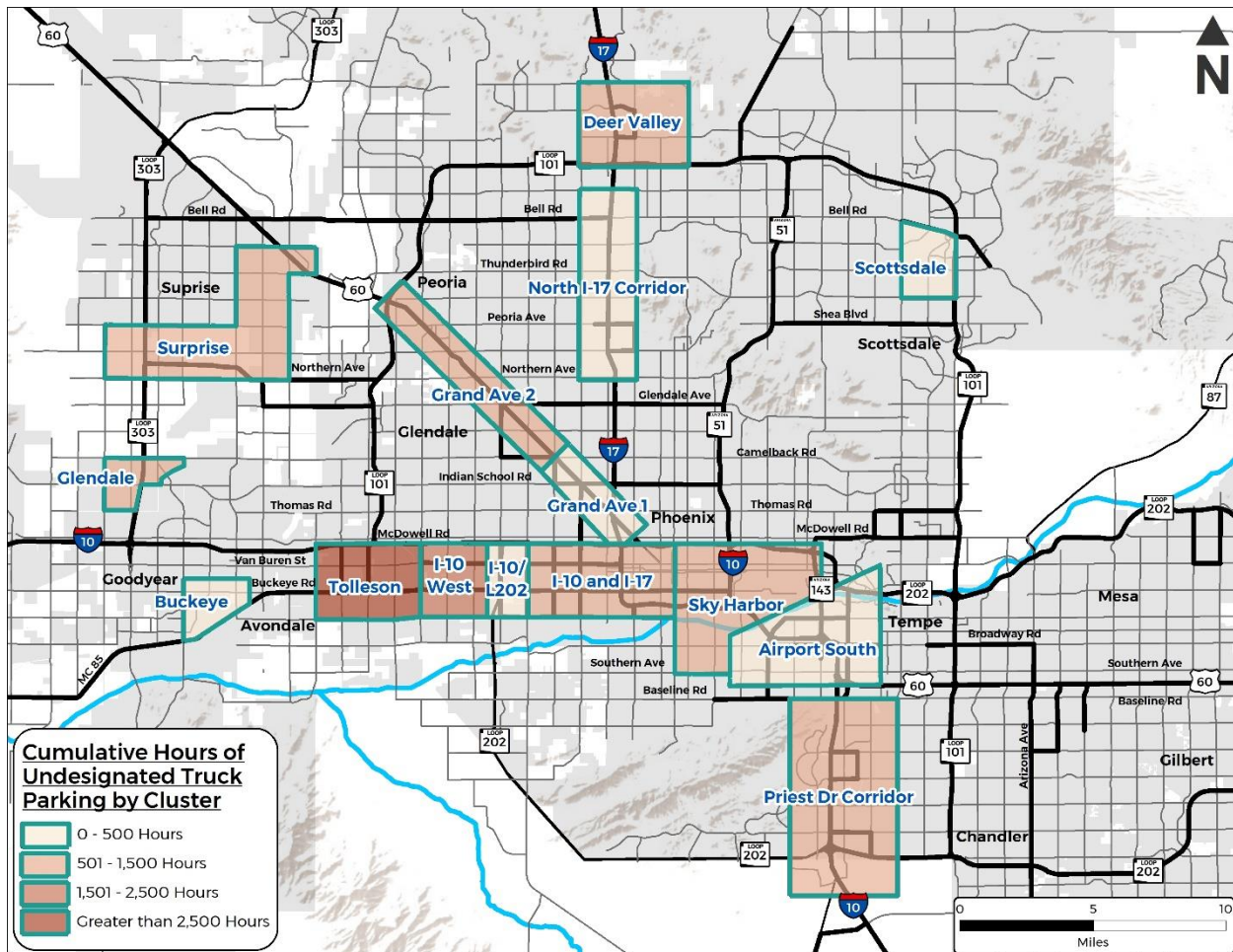
Figure 10 shows the cumulative number of hours of designated truck parking that occurs in each of the industrial clusters. The majority of the hours of truck parking is located in industrial clusters along the I-10 corridor from Tolleson through Phoenix and into Tempe and Chandler. The most significant concentrations of designated truck parking are found in the Tolleson, I-10 West, I-10/L202, 1-10 and 1-17, and Priest Drive Corridor industrial clusters.

Figure 10: Cumulative Hours of Designated Truck Parking by Industrial Cluster



The needs often extend beyond designated truck parking. This leads to undesigned truck parking concentrations in industrial clusters. **Figure 11** shows the cumulative number of hours of undesigned truck parking that occur in each of the industrial clusters. Most are along the I-10 corridor with a notable concentration in the Tolleson Industrial Cluster.

Figure 11: Cumulative Hours of Undesignated Truck Parking by Industrial Cluster



These reasons for undesigned truck parking in industrial clusters usually center around two factors:

- Not enough parking being available on-site at industrial establishments
- Truck drivers needing to park close to their intended destination to wait before their appointment

Undesignated parking is only an estimated 1.5% to 2% of total parking hours in these clusters, as illustrated by the difference in scale in **Figure 10** and **Figure 11**. Undesignated parking tends to concentrate in areas where designated parking is also concentrated. Businesses—especially those in areas with a high density of industrial activity—will only acquire as much land as needed for their operations and nothing more. This leads to establishments in industrial clusters having minimal excess of land to accommodate parked trucks that are waiting for their appointment or for docks to open.

There are other reasons why establishments might not like third-party employees with large vehicles spending excess time at their facility, including liability, deterioration of pavements, littering, lack of amenities, etc. Therefore, this leads truck drivers to park just outside of the facility until they are allowed to load or unload the cargo. In an industrial cluster, this manifests into many roads in and around the cluster being lined with trucks waiting to be allowed into facilities.

In clusters that contain I-10 in their geographies, a large portion of the undesignated parking is also caused by overflow issues at designated stops with drivers looking to satisfy 10-hour HOS requirements (described in more detail in Section 3.2). In terms of raw parking hours, undesignated parking for this purpose may overwhelm undesignated parking for short-term staging purposes. However, most of the locations that are used to park for staging are undesignated, because a premium is placed on being close to the facility. **Figure 12** illustrates the common problem of undesignated truck parking while staging for delivery.

Figure 12: Industrial Cluster Parking along I-10



Another reason for the need for undesignated parking in industrial clusters is related to how truck drivers and their dispatchers deal with roadway congestion. Given the limited space on-site to accommodate trucks, establishments place a high premium on trucks arriving on-time and use the valuable dock space when scheduled. This leads truck drivers and dispatchers to build a buffer into their schedule so that a timely delivery can be guaranteed, which translates into trucks arriving early to the facility most of the time and having to wait for their appointment. The higher the congestion and unreliability that is expected, the longer the truck driver has to wait. This need for drivers to remain on schedule causes undesignated parking adjacent to freight-generating facilities. Undesignated truck parking is more severe in industrial clusters located in central locations that see significant congestion during peak hours of the day. Given that the buffer in the schedule was intended to deal with congestion, truck drivers are reticent to find parking even a couple of miles away from where they make a delivery or pick up a load, because it exposes them to risks. Even if parking is available relatively nearby—say, a couple of miles away—a roadway crash, the closure of an at-grade crossing, or some other unexpected event could lead the driver to miss their appointment.

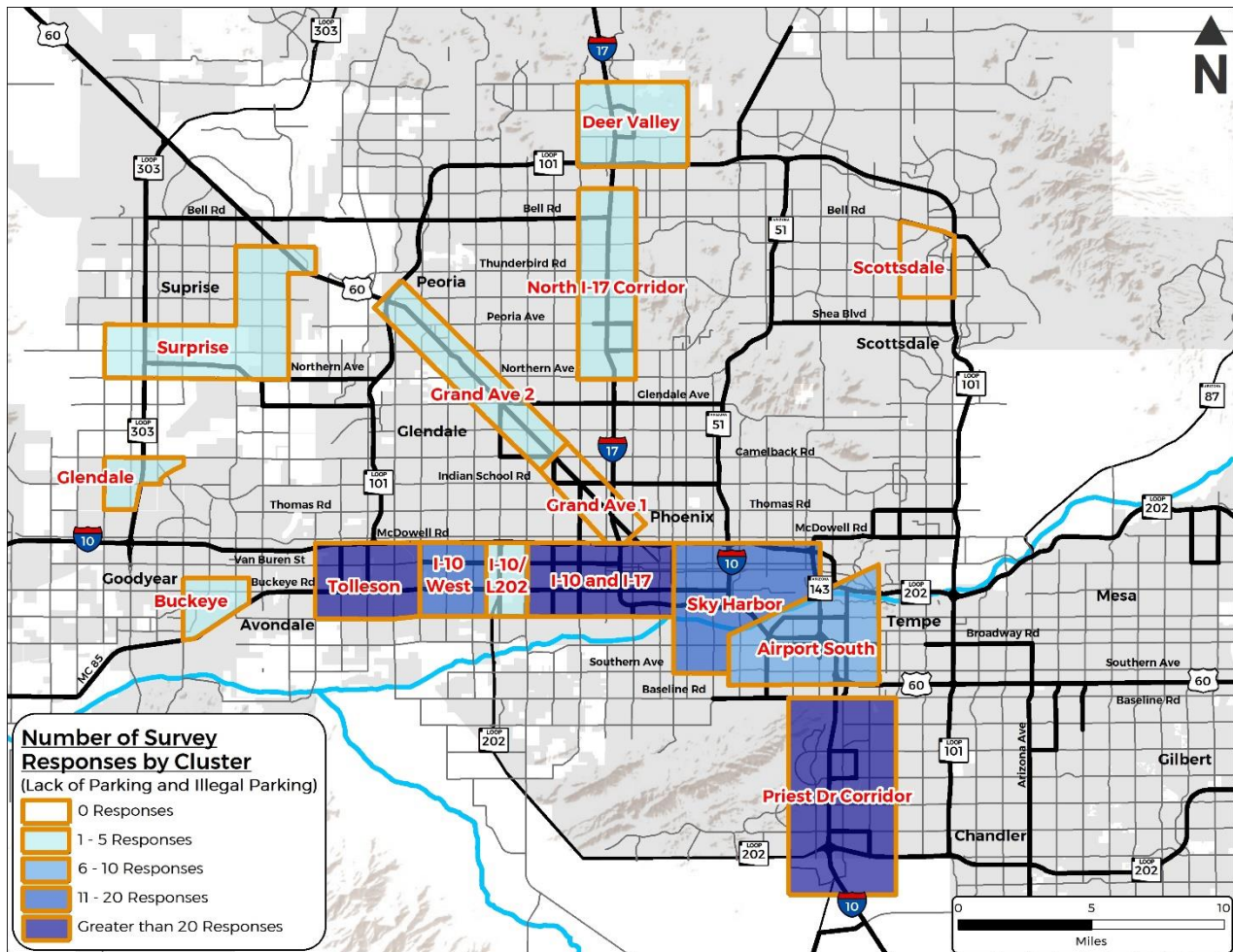
The analysis conducted by this study found significant differences between the parking needs of different types of establishments and land uses. Establishments with in-house fleets will have the

highest parking needs at night, when their fleet is not used. These facilities are likely to have enough parking capacity on-site, and therefore should not generate significant undesignated staging parking. For establishments that rely on truckload service (i.e., the whole truck is contracted at once), parking demand is affected by whether the establishments contract is “drop-and-hook” freight or live-load freight. Drop-and-hook requires parking (and may need an appointment) but the duration is short because the truck comes in to drop a load and/or retrieve an empty, and then leaves. Live loads, which are often found at grocery warehouses, need parking for a longer period while the truck is unloaded and generally requires a scheduled appointment so that facility workers are available to move the freight on and off trailer. If the schedule falls off track, there is a heightened risk of parking backups at the facility. On the other hand, establishments that rely on less-than-truckload service (i.e., truck collects cargo from multiple clients) have a need for parking multiple trucks for relatively short durations. Some establishments rely on both truckload and less-than-truckload service and have a mix of parking needs.

All this translates to a significant parking need in industrial clusters, particularly for staging purposes. This need will be the greatest in areas where facilities have the least on-site parking space—in areas that are most affected by congestion or unreliability during operating hours of the day. To look at the issue from another perspective, **Figure 13** depicts the concentration of survey responses regarding lack of truck parking and illegal truck parking for each industrial cluster. It also shows a high concentration of responses in clusters along I-10. Tolleson, I-10 and I-17, and the Preiset Drive Corridor clusters each contained more than 20 responses to this question, for example.

However, the analysis also shows that these needs will vary considerably by establishment type. Even within the same establishment type, there can be significant variability, depending on the operations of the facility and type of trucking service used. Regardless, parking in industrial areas for staging purposes does not require extensive amenities, because proximity to the destination is the primary consideration for drivers.

Figure 13: Number of Survey Responses (Lack of Truck Parking and Illegal Truck by Industrial Cluster)



3.1.2 Solutions

While the set of potential solutions will be specific to each location, they can generally be characterized by the type of need being addressed. In instances where drivers line up on roads in and around the industrial cluster for staging purposes, a variety of recommendations could be appropriate. At a minimum, truck drivers entering industrial zones should be made aware of public or private truck stops in the vicinity of the cluster, whether through static or dynamic message signs, through smartphone and web apps, or through distributing visitor card trucking maps at trucking conferences and other events. However, this solution may not effectively alleviate the issue in some industrial clusters. As suggested in the prior section, if the parking facility is even a few miles away from the staging zone, the drivers may be incentivized against parking there. If excess public right-of-way, vacant land, or unmarked public lots are available in the vicinity of the staging zone, a more appropriate solution could be to convert one or more of these spaces into off-street staging zones and adding clear demarcations and roadway signs. It would be important to identify who would be responsible for maintenance prior to opening vacant property to truck parking.

If the cluster generally consists of establishments with in-house fleets (as some major retailers do), a potential solution could be to investigate parking agreements directly with their locations, if they do not already allow parking of external fleet vehicles. Consideration should be given to private online parking marketplaces such as SecurSpace,¹ which attempts to connect drivers looking for parking options to those with dedicated or excess capacity. SecurSpace currently has one parking listing in Phoenix at W Washington Street and N Central Avenue.

Where on-street parking is permitted, curb management solutions such as Coord² or ParkMe³ provide drivers with access to real-time information of the location and availability of curbside parking spots managed by the city, and allows them to either reserve such on-street parking spots or make appropriate arrangements in planning the timing and route of their trip to industrial clusters in the city.

Another solution may be to modify parking ordinances to allow for more capacity on-street where on-street parking is prohibited but roadway geometrics safely allow for increased on-street parking. As noted by the SET, this may be difficult to achieve due to public opposition in many areas. Limiting expansion to certain types of vehicles or for limited hours, may be more acceptable. In any case, public education about the need for truck parking would be critical to any truck parking increase. is important.

On the other hand, if trucks stopped on-street for staging purposes are currently prohibited for safety reasons, increased and more visible No Parking signage and increased enforcement of regulations would reinforce on-street parking prohibitions. Increased enforcement, in combination with other options, might nudge drivers to parking at alternate locations.

Finally, by modifying local truck ordinances, zoning authorities may also require on-site and off-street staging areas for facilities and businesses that regularly receive freight shipments.

¹ <https://secur.space/>

² <https://www.coord.com/>

³ <https://www.parkme.com/>

3.2 Overflow Parking at Truck Stops and Rest Areas

3.2.1 Need

In addition to industrial clusters, undesignated parking was also found primarily in vacant, transportation, agriculture and open space land uses around truck stops and rest areas. While not confined to any specific geography in the MAG region, such undesignated parking was found to occur along all major truck corridors (such as the I-10, Route 60 and I-17). Undesignated parking was found to occur both on-street and to cluster around truck stops (indicating limited parking availability at these facilities).

The undesignated overflow parking issues at these truck stops result primarily from two patterns:

- The need for truck drivers passing through or destined for the MAG region to comply with the federal HOS regulations.
- The location of these truck stops along interstates and Route 60 just outside Phoenix that allows them to serve as staging locations for drivers looking to enter the downtown industrial clusters in the morning.

These patterns occur at truck stops such as the QuikTrip and Love's south of I-10 in Buckeye and the Carioca/Minute Mart/Pilot truck stop in the Wittman area along Route 60, north-west of Surprise. The primary issue at these truck stops is a lack of sufficient parking capacity, which forces drivers to park on or alongside access roads leading up to these truck stops or on vacant unmarked lots surrounding these stops. The poor lighting at these unmarked lots and overflow parking exacerbates safety and security concerns at these locations.

On-street parking and overflow at truck stops (which are indicative of capacity not matching demand) were more likely to be problematic due to the safety concerns they pose to both trucks and other road users. **Figure 14** shows the street constriction that can occur with undesignated overflow truck parking.

Figure 14: Undesignated Overflow Parking at Designated Truck Stop in Phoenix, AZ



Outside of insufficient parking spaces at specific truck stops, drivers have reported a lack of parking generally along the interstate and regional corridors leading up to Phoenix. This funnels drivers to the stops mentioned above because they are mandated to meet HOS requirements and struggle to find sufficient parking spaces elsewhere overnight.

3.2.2 Solutions

One recommendation is to improve real-time communication to drivers of the location and availability of parking at truck stops and rest areas in the region. Respondents to the survey indicated that they strain to find overnight parking at these locations on many days. Providing drivers with real-time parking availability information allows them to find alternative solutions ahead of time and alleviate overflow parking at existing stops. Sensing technologies such as in-pavement sensors, entry-exit gates, and camera systems can be used to determine utilization and availability of parking spaces and communication media such as dynamic message signs, smartphone and web apps, and in-cab navigation can be used to disseminate the information to truckers in real time.

The I-10 Corridor Coalition—composed of the departments of transportation in Arizona, California, New Mexico and Texas—is looking to implement such a truck parking availability detection and information system at 37 public truck-parking locations along the I-10 Corridor from California to Texas. Once implemented, this technology deployment will provide drivers with the opportunity to develop alternate plans to meet HOS requirements in advance of arriving at parking sites in the Phoenix region. While this deployment is currently limited to the I-10 corridor, the technology can be expanded to major truck corridors in the region.

Because the need in these locations is a lack of sufficient parking, consideration should be given to capacity expansion. For instance (as mentioned earlier in this section), there is vacant land in the vicinity of the truck stops in Wittman and Buckeye. Coordination with the truck stop operators might reveal whether this could be achieved as an entirely private matter or whether public support is needed. Therefore, it may be of interest to investigate whether capacity can be expanded at these stops either through the use of publicly owned excess rights-of-way at these locations or through improving parking stall geometrics within the stop. Parking availability at these locations could be tracked to understand the amount of additional capacity required.

In the event that the additional capacity required exceeds what is potentially available via expansion of the existing truck stops, further consideration could be given to building new parking locations along the interstates and Route 60. These can be bare-bones facilities, providing essential features such as fencing, lighting, restrooms, vending machines and Wi-Fi, and not much else. As suggested in Section 2.2, “Best Practices Review”, cost-sharing agreements with private partners for construction and maintenance of parking should be investigated if public funding is insufficient. Private partners may also be allowed to set up stalls at such facilities to provide revenue incentives for engaging truck parking expansion.

3.3 Dispersed Parking

3.3.1 Need

While most of the ATRI analysis and driver survey responses identified undesignated parking at locations near industrial clusters and truck stops on major freight corridors, a few sites were scattered across the region. These sites, while not major freight generators, still exhibited either supply/demand imbalances, safety issues arising from truck parking, or other issues. With instances of undesignated parking in dispersed locations, it is difficult to observe common patterns of need because the parking issues tend to be localized. For example, in the City of Maricopa, one issue related to truck parking arose from a lack of safe staging and loading/unloading zones in the main commercial center. Trucks are forced to access these zones through the parking lots of grocery stores, which is disruptive. Survey respondents also pointed to a generalized lack of sufficient truck parking capacity in Maricopa because the city does not allow truck parking in residential and commercial districts. On the other hand, in downtown Tempe, narrow streets were the culprit, with drivers facing increased difficulty when maneuvering their trucks. Constrained delivery zones may pose a safety issue as trucks are sometimes required to park in fire lanes to complete deliveries.

3.3.2 Solutions

The required solutions will vary, depending on the specific type of need at each location. In the example of the City of Maricopa, one potential solution could be to partner with retail establishments to provide clearly marked and specific staging and overnight parking zones. However, this would also require a change in regulations because the city bans truck parking in commercial (and residential) districts. In downtown Tempe where the need is primarily safety-oriented, the most pertinent solution would be increased enforcement of on-street parking regulations to reduce safety hazards posed by trucks in fire lanes and other constrained on-street spaces. To be effective, such enforcement would also have to be paired with efforts to expand the effective supply of parking capacity within the municipality, either through a review of current publicly owned land uses (as potential sources of capacity) or through better communication of on-street and off-street parking facilities to truck drivers. The turnover in store-front retail—accelerated by e-commerce growth during the pandemic and exacerbated by office workers staying home—may create opportunities in commercial districts where land availability traditionally was constrained. These might be paved, lit parking lots at declining or abandoned malls, shopping centers, and even office buildings, which could be deployed as temporary arrangements until new uses for land are found, or as permanent solutions.

4. CONCLUSION

This memorandum summarizes the results from previous deliverables in this study and synthesizes salient findings to describe truck parking issues and opportunities identified in the region. Different needs are characterized for three key geographic patterns:

- Truck parking needs around industrial clusters
- Overflow parking needs at truck stops and rest areas
- Dispersed truck parking needs

Recommended solutions are drawn from review of truck parking best practices, stakeholder outreach, and the addendum to the *Truck Parking Patterns* memo. Generally, potential solutions are oriented around the type of need arising in each of these geographic patterns. Strategies range from technologies such as **real-time communication** of parking availability, **increased enforcement** of parking regulations, **changes in the parking regulations** themselves and **capacity expansion** via conversion of relevant public land uses or through private partnerships.

After vetting these strategies with the SET, the next step would be to formally recommend specific solutions for each of the three types of needs and identify next steps for implementation, including potential pilots for specific strategies or locations.